
SOIL FERTILITY MANAGEMENT FOR SUSTAINABLE AGRICULTURE

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and
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FOREWORD

The world population is expected to double within the next three to five decades, thus making the task of several national agricultural systems more difficult to provide needed food security. This is likely to be further complicated by environmental problems, which are cropping up due to intense use of chemicals. Therefore, sustainability of national agricultural systems is a major concern today. Management of soil fertility and soil health is the key to the development of sustainable agriculture.

Focusing attention on soil fertility in relation to sustainable agriculture is the need of the day. In view of this, it gives me great pleasure to write the foreword for this book entitled *Soil Fertility Management for Sustainable Agriculture* jointly authored by Dr. Rajendra Prasad, an eminent agronomist from India, and Dr. J. F. Power, a pioneer of soil fertility management from the U.S. Although the basic principles of soil fertility management for sustainable agriculture in temperate and tropical regions remain the same, the environmental factors, such as high temperature and heavy precipitation during short spells of time, make management practices more difficult under tropical conditions. It is thus gratifying to see a joint effort by two experienced researchers and teachers in producing a textbook on soil fertility using data from tropical as well as temperate regions and presenting the fundamentals of soil fertility for the benefit of students. This book is an excellent reflection of the Indo–U.S. Senior Scientists Panel Program, and I am sure it will prove useful to all concerned.

R. S. Paroda

Secretary to Government of India
Department of Agricultural Research and Education
Ministry of Agriculture
Indian Council of Agricultural Research
New Delhi

PREFACE

Sustainable agriculture is now on the agenda of agricultural institutions over the entire world. Most national governments are concerned with this issue. The problem is aggravated by environmental hazards associated with modern technology in the agriculture of advanced countries. There are also pressures to reduce the use of agricultural inputs, such as chemical fertilizers and pesticides, and to cut down on the use of farm machinery dependent on fossil fuels. With reduced chemical input, the United States can still produce enough food to meet its own needs, as well as the needs of several other parts of the world, but most developing countries with ever-increasing population pressure cannot afford to cut down the use of agricultural chemicals, especially chemical fertilizers. They must produce more and more food and yet maintain the fertility of soils. Soil fertility management for sustainable agriculture is therefore a primary concern.

There is a growing demand on young agricultural graduates coming out of U.S. universities to serve in developing countries in Asia, Africa, and South America. The soil, climate, and crop conditions in these continents are much different than those prevailing in the U.S. and Europe. Several countries have tropical and subtropical climates with large areas under oxisols, ultisols, and saline-alkali soils. Although there has been considerable research in the U.S. on such soils, not much has been placed in our textbooks on soil fertility. It is highly desirable that undergraduate students in agriculture in all universities have greater exposure to soil fertility problems in these other continental soils and in their management.

Also, most textbooks on soil fertility available to the millions of undergraduate and graduate students in developing countries of the world are based on scientific information obtained in advanced countries from temperate regions, such as the United States, United Kingdom and other European countries. While the basic principles of soil fertility apply to all soils, there is an urgent need for a textbook on soil fertility that incorporates available and useful scientific data obtained from developing countries.

The approach of this book is to present the principles for controlling soil fertility in the various climates of the world and to provide examples of soil fertility management for sustainable agriculture from both tropical and subtropical regions, as well as from the temperate regions.

ABOUT THE AUTHORS



Dr. Rajendra Prasad is the former Chair of the Division of Agronomy, and now, ICAR National Professor at the Indian Agricultural Research Institute (IARI) in New Delhi, India. Dr. Prasad holds B.Sc. (Ag.) and M.Sc. (Ag) (1956) degrees from Agra University, Government Agricultural College, Kanpur Campus, and a Ph.D. degree (1961) from Mississippi State University. He is a member of Phi Kappa Phi. Dr. Prasad has published over 150 research papers and participated in a number of national and international seminars. He is a recipient of the

Hooker Award of the Indian Agricultural Research Institute (New Delhi), the Rafi Ahmed Kidwai Prize of the Indian Council of Agricultural Research (New Delhi), and the Silver Jubilee Award of the Fertilizer Association of India (New Delhi) for his contributions in soil fertility and fertilizer nitrogen management. He is a Fellow of the Indian National Science Academy and National Academy of Agricultural Sciences (India). Dr. Prasad was the Secretary of the Indian Society of Agronomy for the period of 1975 to 1978 and was Vice President and Executive Chairman for 1979 and 1980. He is a member of editorial board of the *Journal of Agronomy and Crop Science*, Berlin. Dr. Prasad has been teaching a course on soil fertility and its management at IARI for the last 20 years and has guided over 30 graduate students in obtaining their Ph.D. degrees in agronomy. His students today occupy senior positions in state agricultural universities, institutes of the Indian Council of Agricultural Research and Council of Scientific and Industrial Research, and the fertilizer industry in India.



Dr. James F. Power is Research Leader for the Soil and Water Conservation Research Unit of the Agricultural Research Service (ARS) of the U.S. Department of Agriculture located at the University of Nebraska, Lincoln, Nebraska. He leads a group of nine ARS scientists, plus post-doctorates, visiting scientists, and graduate students, in a research program dedicated to improvement of sustainable agricultural production practices that maintain or

enhance economic production and environmental quality. His B.S. (1951) and M.S. (1952) degrees in agronomy are from the University of Illinois, and his Ph.D. (1954) in soils is from Michigan State University. He has had over 40 years of employment as a Research Soil Scientist with ARS: 6 years at Sidney, Montana; 18 years at Mandan, North Dakota; and over 16 years at Lincoln, Nebraska. He is a member of a number of honorary societies and a Fellow in the Soil and Water Conservation Society, American Society of Agronomy, Soil Science Society of America, and American Institute of Chemists. In 1996, he was elected Fellow of the National Academy of Agricultural Sciences (India). He has held various offices and committee assignments in the above societies, as well as serving in several positions on the editorial staffs of their journals. In 1990 he was Scientist of the Year for the Northern Plains area of ARS. He has conducted extensive research on nitrogen nutrition and interactions with water availability for grassland soils, reclamation of lands disturbed by strip-mining, tillage methods (especially reduced and no-till) for grain production, and nitrogen cycling in cultivated ecosystems. He has served on the advisory committee for a number of graduate students. He and his graduate students have published over 200 peer-reviewed journal papers and book chapters.

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DEDICATION

The authors wish to dedicate this book to their wives

*Uma Prasad
Marlene Power*

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